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GB 250209
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(54) **Machine for Transforming Sea-wave Motion into Mechanical Energy**

(57) Three co-operating units (10, 11, 12), each one formed by a float (24, 29, 34) are activatable in a reciprocating movement by sea wave motion and mechanical means (18, 19, 21—23, 25—28, 30—33) are provided for the direct transmission of the reciprocating movement of each float (24, 29, 34) to a transmission shaft (13) actuable in a unidirectional rotational movement intended to be associated, e.g. with an electric generator.

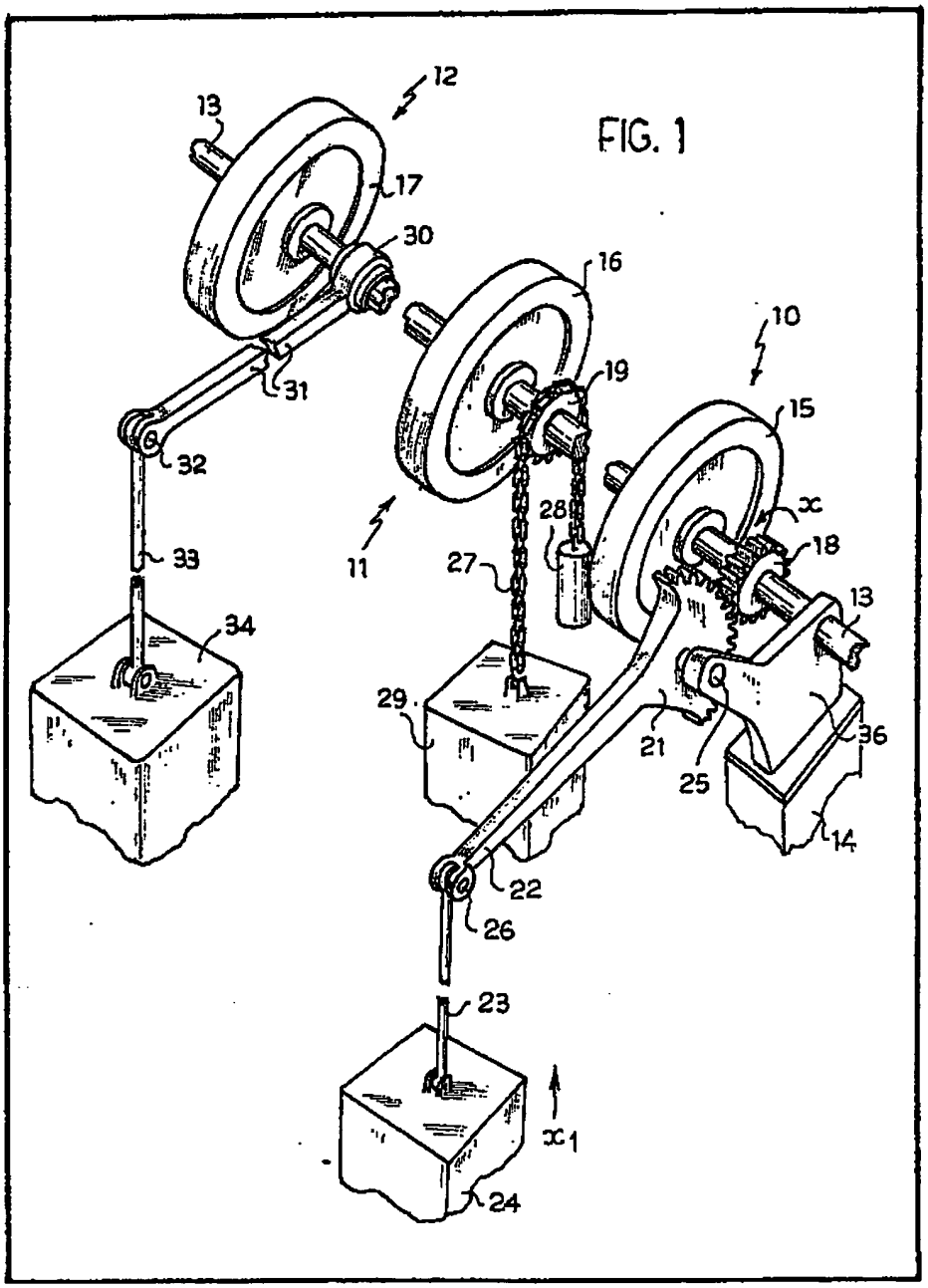

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FIG. 1

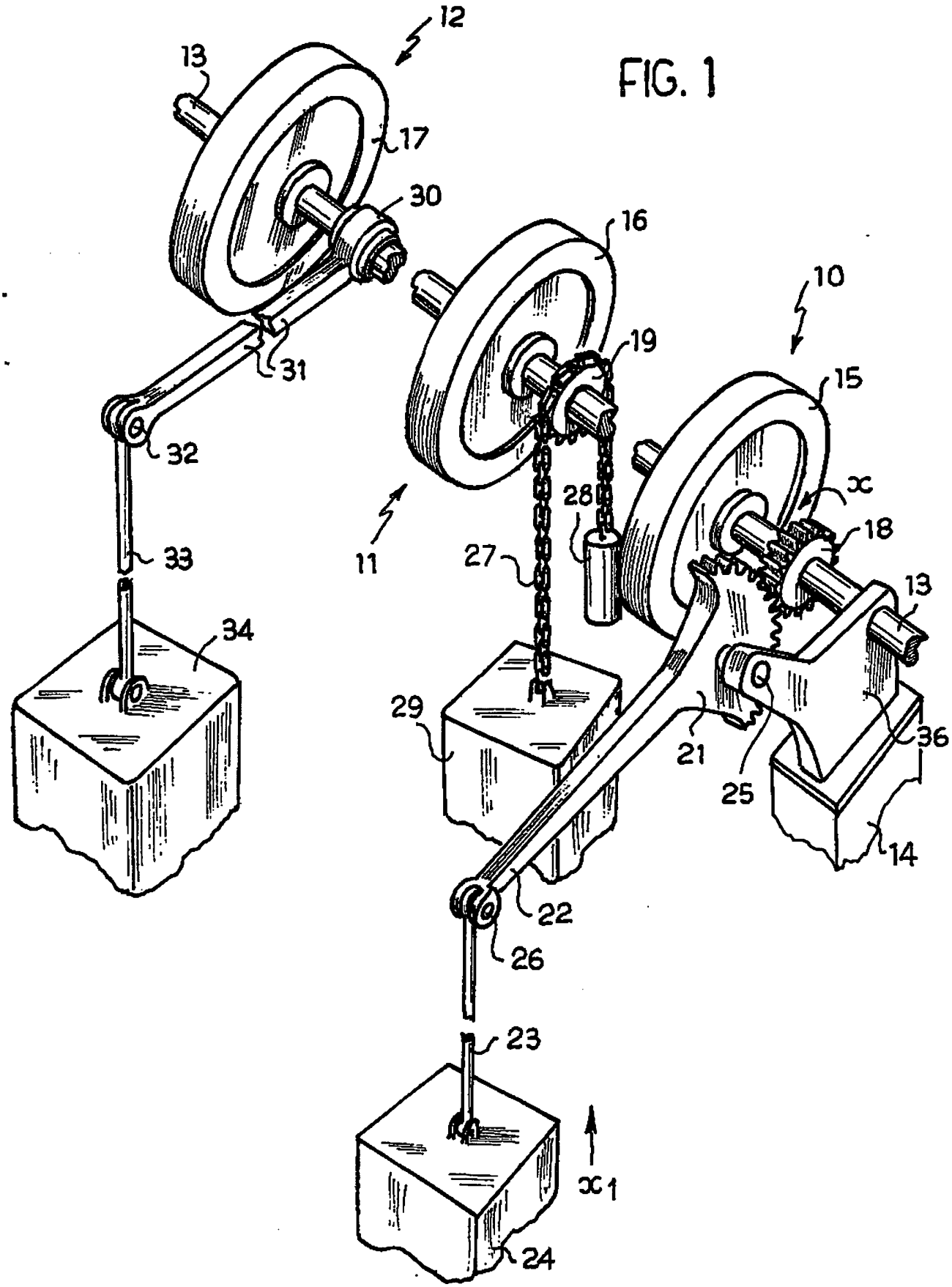
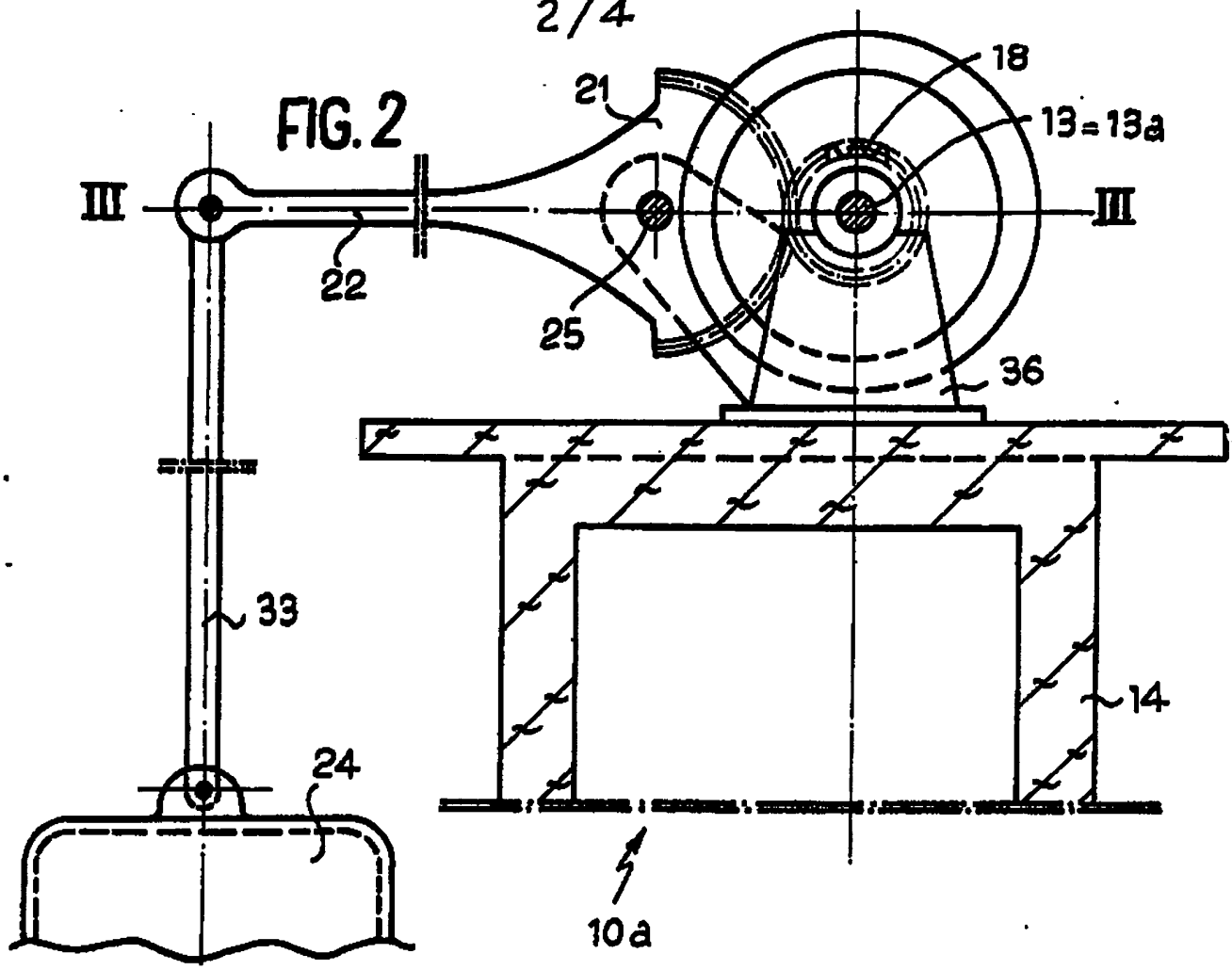


FIG. 2



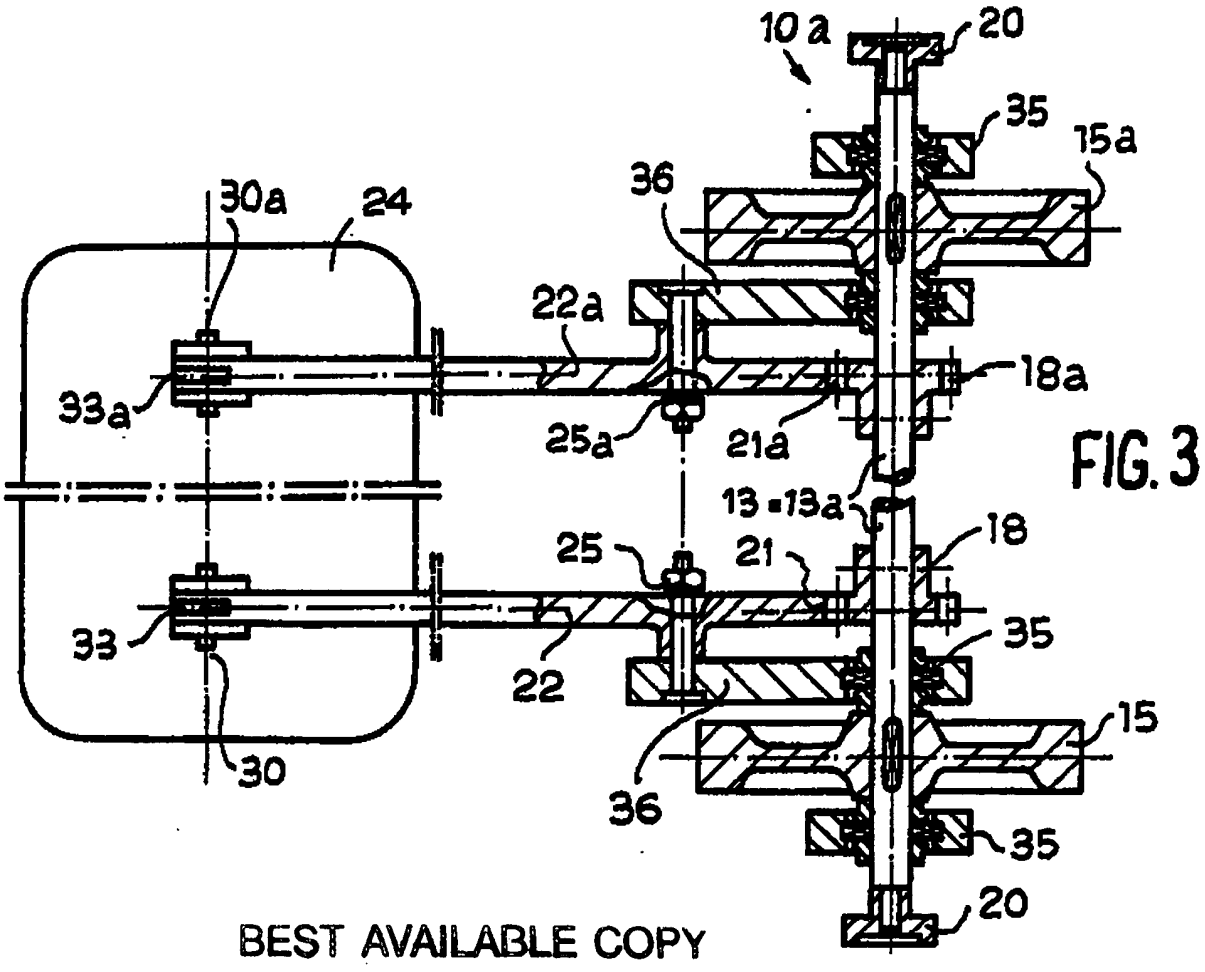


FIG. 3

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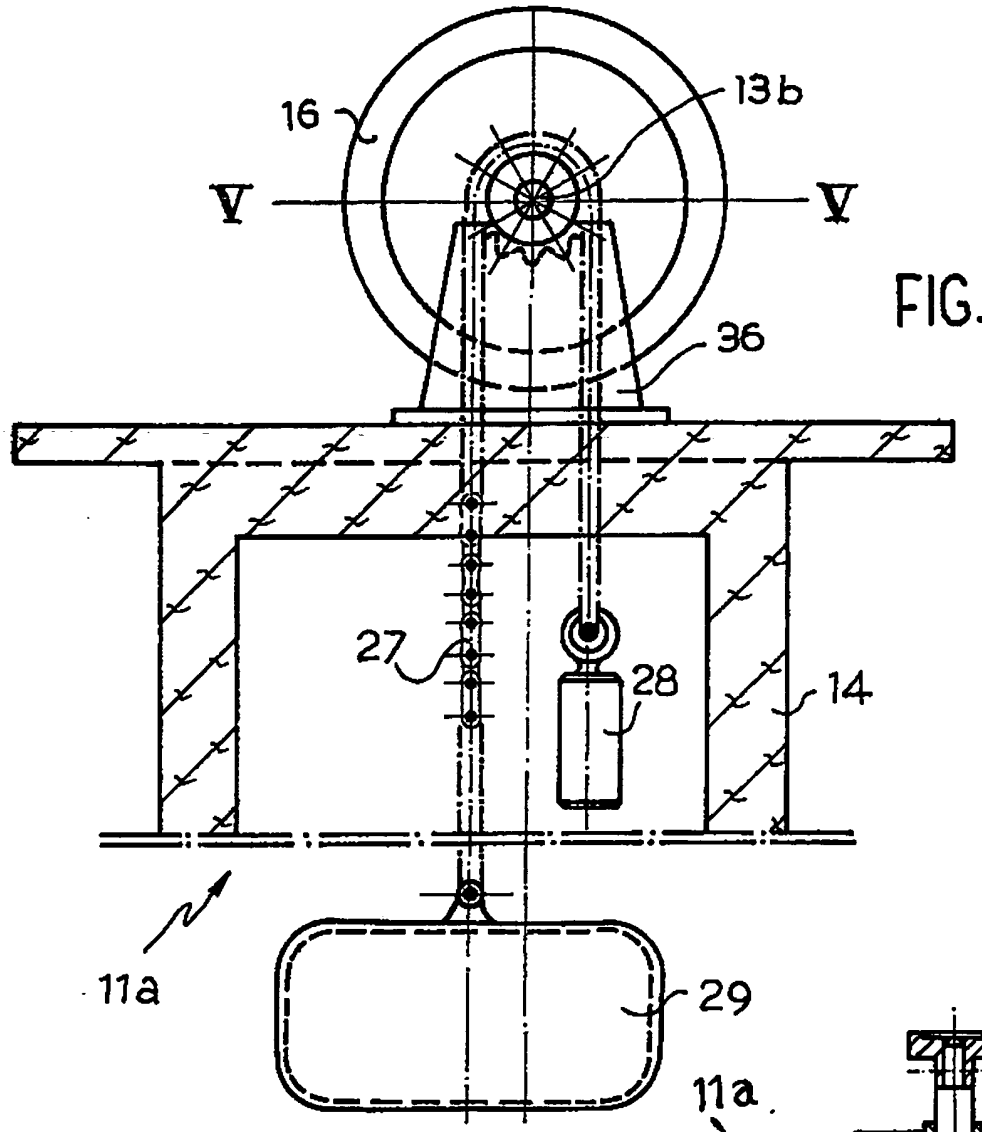


FIG. 4

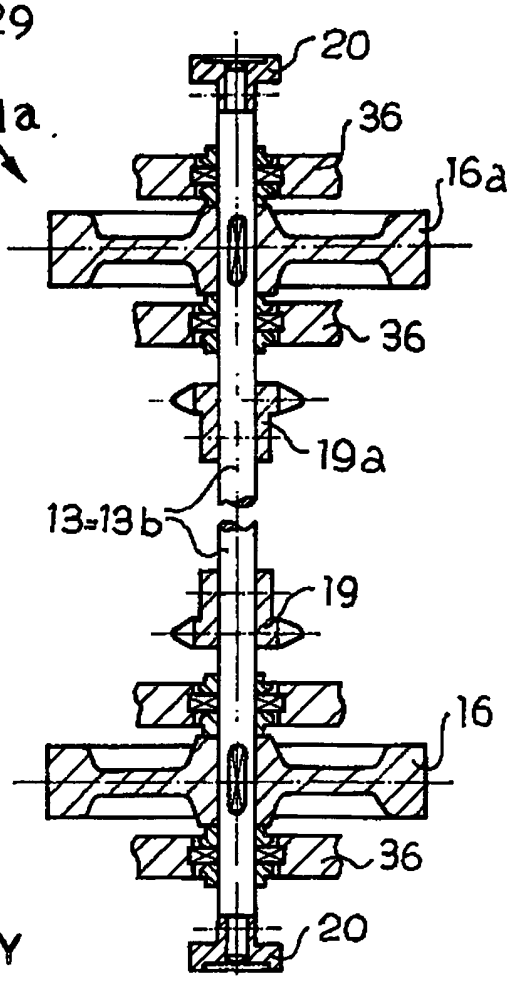
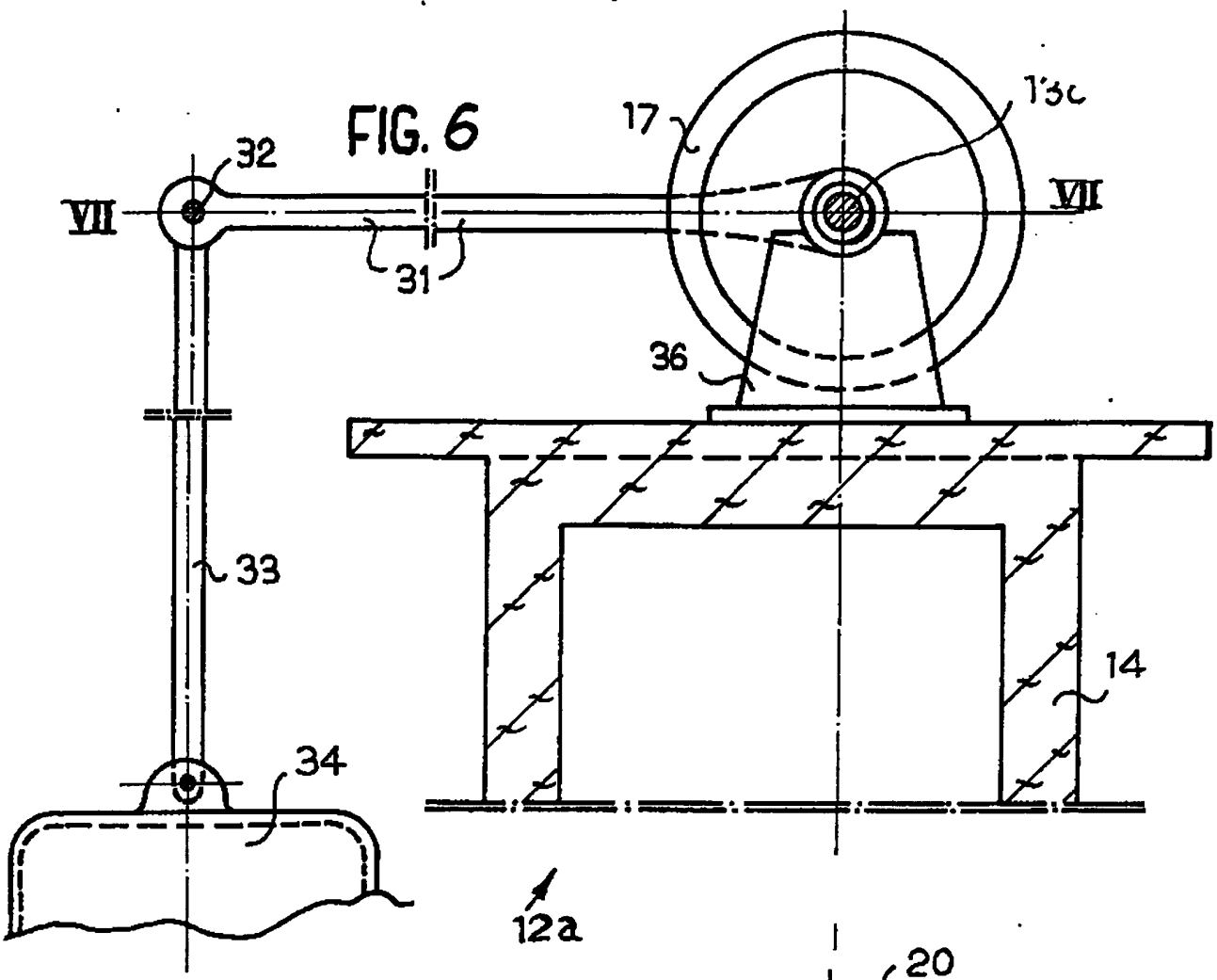


FIG. 5

FIG. 6



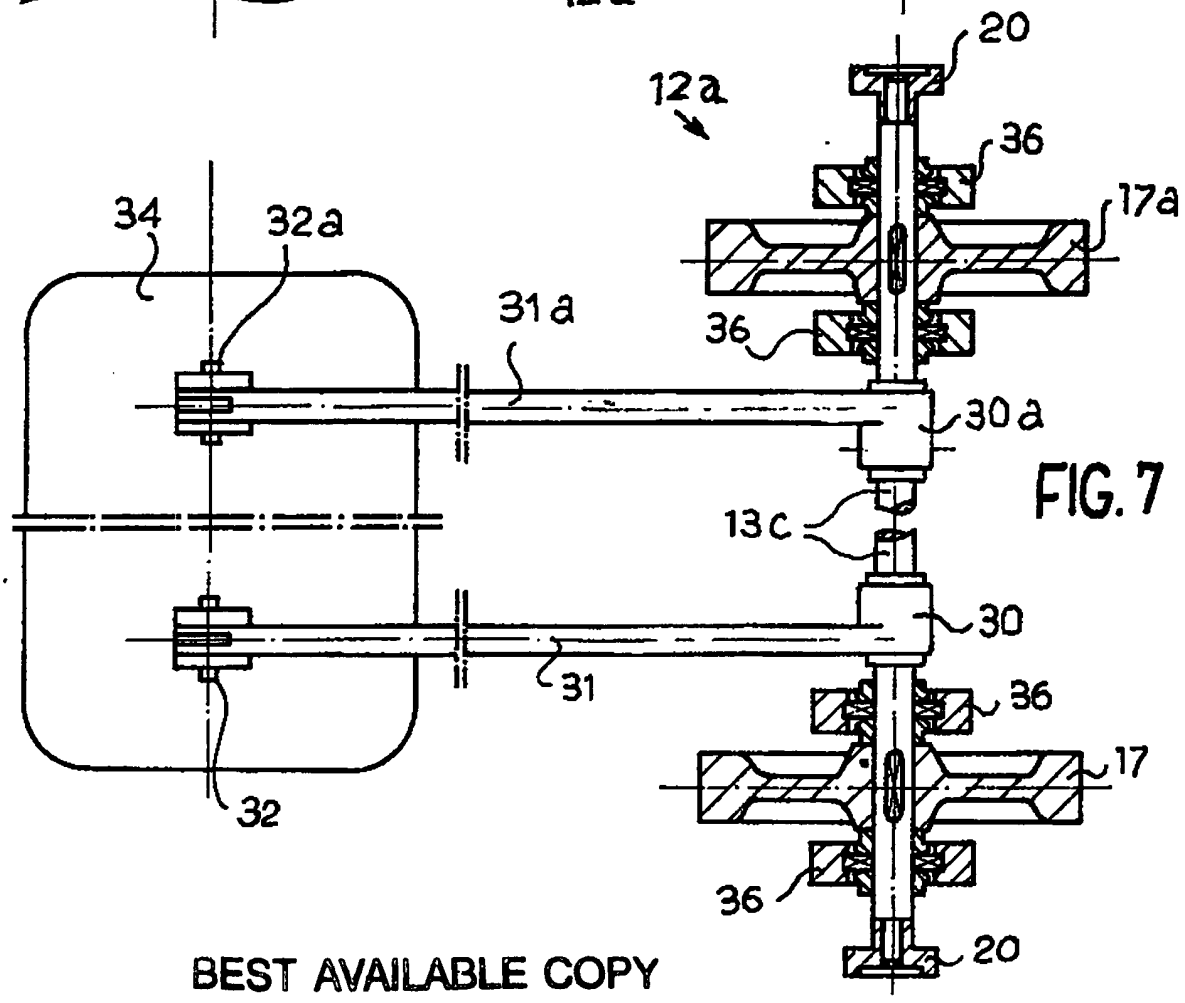


FIG. 7

SPECIFICATION

Machine for Transforming Sea-Wave Motion into Mechanical Energy

This invention relates to a machine for transforming sea-wave motion into mechanical energy.

Some attempts have been made to devise machines for transforming seawave motion energy into utilizable mechanical energy. Most of these attempts have not given useful results because the plants required were expensive and of low efficiency.

The main object of the present invention is to provide a generator machine having a simplified structure and therefore economically feasible initial and maintenance costs. The machine may be adapted to be located in the proximity of canals, bays or other suitable points where, due to the geographic location and the outline of the coast, the sea wave motion maintains an average force and rarely decays to flat calm or reaches storm intensity.

According to the invention there is provided a machine formed by one or more units independent (in the case of there being more than one such unit) of, and associatable with, one another, for transforming the kinetic energy of sea waves to mechanical energy, characterized in that the or each unit comprises a floating member for directly transmitting the reciprocating movement generated by the sea wave motion to freewheels, and at least to one coupling with a freewheel or a unidirectional clutch, whereby the reciprocating movement of said floating members is transformed into a unidirectional rotary motion, and a shaft associated with one or more fly-wheels, and connectable to a machine generating electrical energy or to an operating machine.

Preferably there are three such units.

The invention will be described by way of example with reference to the accompanying drawings, wherein:

Figure 1 is a perspective schematic view of three units forming a typical machine;

Figure 2 is a side elevational view of one of the three units;

Figure 3 is a plan view of the Figure 2 unit with a partial section along a horizontal plane arranged along line III—III of Figure 2;

Figure 4 is a side view of the second unit of the device;

Figure 5 is a partial plan view of same unit with a section in a horizontal plane arranged along line V—V of Figure 4;

Figure 6 is a side view of the third unit; and

Figure 7 is a plan view of the unit represented in Figure 6, with a section in a horizontal plane arranged along line VII—VII of Figure 6.

With reference to Figure 1, a typical machine according to the present invention comprises, preferably, three units, generally indicated by the reference numerals 10, 11, 12. Three fly-wheels 15, 16, 17 (Figure 1) are keyed on a common shaft 13 or on shaft parts 13*a*, 13*b*, 13*c* (Figures 3, 5, 7) provided with terminal half-joints 20 for axially coupling the three units.

A first toothed freewheel 18 is coaxially mounted on shaft 13 and engages the shaft in fixed relation when the freewheel rotates in the direction indicated by arrow X. The shaft 13 is rotatably mounted on bearings, not shown, with respect to a base 14 having a suitable structure; the toothed crown of the freewheel 18 is always engaged with a toothed sector 21 pivoted at 25 on the support 36. Sector 21 is integral with arm 22 which, in turn, is articulated at 26 to the end of a connecting rod or tie rod 23 which at its opposite end is articulated to the top of a float 24.

A second freewheel 19 is mounted near the flywheel 16 and, like the freewheel 18, it becomes torsionally integral with shaft 13 when rotating in the direction indicated by arrow X. A suitable length of chain 27 engages the toothed crown of freewheel 19 and has its ends, respectively, anchored to a counter-weight 28 and to a float 29 whose weight exceeds that of the counter-weight 28. On the shaft 13, or on a shaft portion coaxially connected to shaft 13, a third fly-wheel 17 is keyed and, near that fly-wheel, a freewheel or a friction joint 30 is mounted and provided with an arm 31 which, at 32, is articulated to the end of a connecting rod 33 which in turn is articulated to the top of float 34. The base 14 is mounted on underwater foundations, in places appropriately selected, and its height, with reference to the median sea level, corresponds to the height of connecting rods 23 and 33, and to the length of chain portion 27 anchored to the float 29, added to the height of floats 24, 29, 34.

The sea-wave motion alternately lifts and lowers the three floats 24, 29, 34; the float 24 actuates, like a rocking arm and through the connecting rod 23, the toothed section 21 which engages the toothed crown of the freewheel 18; the rising movement of float 24 corresponds to the active rotational movement of the freewheel 18 which rotates the shaft 13.

In contrast, the rising movement of the float 29 causes the free rotational movement of wheel 19 with respect to shaft 13, and when the wave thrust ceases and float 29 descends by gravity, it produces the rotational active movement of wheel 19 causing rotation of shaft 13. The counter-weight 28 and float 29 may be inter-changed, so that when counter-weight 28 descends by gravity it causes rotation of shaft 13.

The unit 12, comprising the fly-wheel 17, the joint 30, arm 31, connecting rod 33, and the float 34 co-operates with units 10 and 11 when the device is active. Unit 12 has the principal task of overcoming the forces of inertia of the various parts of the mechanism by its friction joint or freewheel 30 and of slowly initiating the rotation of shaft 13 when the sea-wave motion begins again after a period of calm.

With reference to Figures 2 and 3, the unit indicated by numeral 10*a*, analogous to the unit indicated by numeral 10 in Figure 1, according to

a variant, comprises a pair of fly-wheels 15, 15*a*, and therefore, two freewheels 18, 18*a* engaged by corresponding toothed sectors 21, 21*a*; the shaft 13, 13*a* which may be single or formed by a pair of shafts axially connected by joints 20, is supported by bearings 35 mounted on the framework 36 integral with the base 14. In this case, the float 24 may be a single one for both the tie or connecting rods 33, 33*a* or two separate floats may be used.

What has been stated concerning the duplication of the kinematic members of the unit indicated by numeral 10*a* in Figures 2 and 3, is valid for the unit indicated by numeral 11*a* in Figures 4 and 5, analogous to unit 11 of Figure 1, as well as for the unit 12*a* of Figures 6 and 7, analogous to unit 12 of Figure 1.

The number of kinematic members forming each of units 10, 11, 12 of Figure 1 can be appropriately established for each case as a function of the coupling required on shaft 13—13*a*, while the angular speed of the shaft is a function of the transmission ratio established between gears 18 and 21, as well as of the multiple instantaneous movements of the waves which produce the rising movement of the various floats.

From what has been described above the fundamental particular feature of the machine according to the invention is clear, i.e., whatever may be the number of units comprising the machine, the movement of the floats is directly transmitted to shaft 13, with power losses reduced to a minimum due to the simplicity of the components which are utilized and to the limited number of components forming each kinematic unit.

Obviously, the generator is not limited to the arrangements described and schematically illustrated, but, without departing from the scope of the invention, can be further improved and possibly varied, particularly as concerns the arrangement and the number of flywheels 15, 16, 17 which have the double function of making the rotational motion of shaft 13 uniform and of operating as kinetic energy accumulators.

The invention has been shown and described in preferred form only, and by way of example, any many variations may be made in the invention which will still be comprised within its spirit. It is understood, therefore, that the invention is not limited to any specific form or embodiment except insofar as such limitations are included in the appended claims.

Claims

1. A machine formed by one or more units independent (in the case of there being more than one such unit) of, and associatable with, one another, for transforming the kinetic energy of sea waves to mechanical energy, characterized in that the or each unit comprises a floating member for directly transmitting the reciprocating movement generated by the sea wave motion to freewheels, and at least to one coupling with a freewheel or a unidirectional clutch, whereby the reciprocating movement of said floating members is transformed into a unidirectional rotary motion, and a shaft associated with one or more fly-wheels, and connectable to a machine generating electrical energy or to an operating machine.

2. A machine according to Claim 1, characterized in that, at least one said unit forming the machine, comprises a shaft supported by a framework; a fly-wheel keyed on said shaft; a toothed freewheel mounted on said shaft; a toothed sector provided with a lever arm; said sector always in mesh with said freewheel being pivoted as a first class lever with respect to the framework while the end of its arm is articulated to one end of a connecting rod which with its other end is articulated to a float and guided in its reciprocating movement in the vertical direction.

3. A machine according to Claim 1 or 2, characterized in that at least one said unit comprises a freewheel keyed on the shaft and engaged by a chain at whose ends are respectively engaged a float and a counterweight.

4. A machine according to Claim 1, 2 or 3, characterized in that at least one said unit forming the machine comprises one arm which at one of its ends is connected to a joint with a freewheel or a unidirectional clutch and with its other end is articulated, through a connecting rod, to a float guided in its reciprocating movement in a vertical plane.

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